DOCUMENT RESUME

ED 201 306 IR 009 190

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TITLE Using Computers to Manage PSI Sociology.
PUB DATE Aug 80
NOTE 10p.

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Assisted Testing; *Computer Managed Instruction; Data Analysis; *Individualized Instruction; Instructional Development; *Sociology; Student Evaluation
IDENTIFIERS *Personalized System of Instruction

ABSTRACT

Computer managed instruction (CMI) is proposed as a solution to the managerial problems created when introductory level courses with large numbers of students are taught using a self-paced, mastery-learning approach, e.g., Keller's Personalized System of Instruction (PSI). This paper discusses the educational premises of CMI, the advantages of CMI for both the instructor and the learner, and the system sequence for introductory sociology courses, including course and student registration; production, administration, and scoring of tests; and reports to instructors on student performance and test responses. Suggested guidelines for adapting an introductory sociology course to CMI address the definition of objectives, building test questions, structuring a balanced test, question construction, writing prescriptions, designing to specifications, and testing the test. (CHC)

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USING COMPUTERS TO MANAGE PSI SOCIOLOGY

by

Henry D. Olsen

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Using Computers to Manage PSI Sociology

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Introduction

Mass lecture instruction in higher education, especially at the introductory level, is a fact of life on many campuses. Instructional resources, unable to keep pace with growing enrollments further exacerbated by extreme financial constraints, have forced many departments to expand their introductory-level classes into mass lecture courses serving hundreds of students. However, whatever educational benefits are derived in the name of efficiency are often counterbalanced as students and faculty are forced to interact with one another in the decidedly impersonal classroom context necessitated by mass lecture instruction.

Indeed, difficulties associated with mass instruction in higher education has been noted by a number of authors (Baker and Behrens, 1971; Wallis, 1973; Wallace, 1974; Moxley, 1974). At the heart of the problem seems to be the fact that large classes are almost invariable composed of students with heterogeneous interests and abilities, and instructors are typically hard pressed to accommodate such diversity. Forced to tailor the content of instruction to some dimly perceived "typical" or "average" student, the instructor may be proceeding to fast or too slow for most of the class. More importantly, even if the pace of instruction is satisfactory for the majority, it is more than likely that many students will be

experiencing difficulty while others will remain unchallenged.

Two solutions to this dilemma of mass instruction have gained some popularity. The first involves the use of small discussion groups as either a supplement or substitute for the mass lecture format (Baker and Behrens, 1971; Wallis, 1973; Wallace, 1974). Whether run by faculty, or graduate or undergraduate teaching assistants, discussion groups can be used not only to individualize instruction but also to overcome the alienation and passivity associated with mass lecture attendance. A second solution is Keller's Personalized System of Instruction (PSI) which employs a self-paced, mastery-learning approach (Clark, 1974; MacDaniel, 1974; Francis, 1974; Malec, 1975). PSI is unique in that individualization is achieved by allowing students to progress through the course at their own speed while simultaneously providing each student with frequent face-to-face instructional assistance.

Educational Premises of CMI

CMI is designed to help the instructor measure and evaluate student performance throughour a course and to plan effective teaching strategies every step of the way. The system is applicable in courses of any size and any academic discipline, but it is most easily adopted in courses with well-established goals and objectives.

CMI is in no way meant to be a substitute for classroom instruction, but rather a supplement to it. It should be seen as a clerical and organizational aid to the instructor and as a valuable feedback mechanism for students. As such, it can only be as successful as the course for which it is being used.

Any CMI system is only one means to evaluate students but certainly not intended to be the only means. It is specifically not meant to replace such important evaluation practices as essays and written papers, for these can test students in ways that multiple-choice tests can't--individual approach to a problem, choice of details, writing style, execution of an argument, and so forth. Without these kinds of tests, students have no opportunity to actively express themselves in their own words.

Rather than thinking of multiple-choice tests and written tests as mutually exclusive, the instructor can use each type to complement the other. Careful application of multiple choice questions, which tend to promote precision and logical clarity, should only strengthen a student's ability to give his knowledge written expression.

CMI is now being used in a variety of teaching situations with great success inclusing Introduction to Sociology at Medgar Evers College, CUNY. Instructors find CMI indispensable since it now performs a great deal of the staff's work in a fraction of the time that used to be spent. Educationally it is found to be extremely beneficial; instructors find it useful in evaluating students, and students find it helps motivate and guide their work.

Advantages of CMI

There are many facets of CMI which make this educational technique advantageous to both instructional and learning populations. For the instructor CMI can:

perform most clerical tasks, including scoring of tests and computer generation of tests;

provides useful data in the form of (1) a report to each student and (2) reports to the instructor and instructional staff charting each student's progress and giving a statistical analysis on responses to test questions;

provide an open-ended structure for an instructor to organize, in detail, the objectives of a course;

can be used effectively with a self-pacing strategy. For example, an instructor can provide a syllabus outlining course material and test units which accompany that material;

Is user-oriented, or "interactive," and written in English and not computerize. All instructor interaction with the computer is by means of easily-understood question-and-answer sequences at a terminal;

provides a neat, useful repository for an instructor's notes and course ideas in question or exercise format.

For the learner CMI can:

provide students with a means to test themselves on course materials and to assess their level of competence;

gives students a chance to take tests over again as many times as an

instructor specifies. Most students find this a welcome alternative to the one-shot final exam. Studies show that students also learn and retain more by gradual study than by "cramming;"

provide students with a test report within minutes of taking a test;

provide, as part of the student test report, an 'individual' prescriptive assignment (derived from the student's responses) outlining his areas of weakness, and, at the discretion of the instructor, listing questions, reference material, and other study suggestions;

provides a means for students to set their goals and to pace themselves.

System Sequence of CMI

CMI has been designed to perform four (4) general functions: First, register a course and students; second, produce tests; third, administer and score tests; and fourth, report to instructors on student performance and on test responses.

Listed below is an outline of the system sequence for Introductory Sociology couses.

Course and Student Registration

CMI requires that the user supply general course information (school and department name, course number, section, instructors, teaching assistants) as well as the names and ID numbers of enrolled students. CMI allows for easy changes or aditions to entered information. The first step in CMI is to provide general information describing the course. The second step is to register enrolled students by entering their names and ID numbers under sections defined by the particular instructors and staff.

Tests

Once a course has been registered, test questions can be entered. Format, content and length are entirely up to the instructor; the only restriction is that questions be in a multiple-choice form.

Testing and Scoring

During the semester, when a student is ready to assess his level of competency, he reports to the testing site, or center. The student receives a printed copy of the test and a special OMR (Optical Mark Read) gridded card on which to record answers.

The student reads each test question and pencils in the box on the OMR card which corresponds to the correct answer. When the penciled-in card is fed into the card reader at the testing center, the system validates the identifying data and logs the student into the system. In a matter of seconds, the student receives a printed report of how he did on the test, showing his score and the objectives and questions missed, and giving prescriptions for those missed.

It is possible to print student reports on multiple copy paper so that the student, testing site, and instructor may each have copies.

A record of student scores and question choices is stored by the computer for subsequent student analysis and item analysis by the instructor.

Reporting to the Instructor

CMI can produce various kinds of reports, depending on the kind of analysis and the extent of information needed. In response to demands by instructors, CMI produces two basic types of instructor reports--the Student Performance Report, which provides comparative ingormation on the performances of students in the course, and the Item Analysis, which provides a statistical breakdown of responses to test questions.

Student Performance Report

The Student Performance Report can be produced according to a variety of parameters, or specifications, set by the instructor. Reports can be produced to include, for example, data on: 1, all students in a course; 2. all students in a particular section; 3. all students having a particular tutor.

The instructor has a record of student performance from a qualitative as well as

a strictly quantitative standpoint. For example, the instructor can see that Daryl Zanuck improved his score on the retest but that he missed different objectives the second time around. He can also see that one student who had exceptionally good scores steadily improved even more, while another student failed all the objectives and only took the test once. The instructor thus has a comparative reading of that particular tutor's section as well as a handle for probing into particular student problems.

The Item Analysis Report

The second type of report, the *ITEM ANALYSIS*, gives statistics on student responses to test questions.

The advantages to the instructor of such statistics have been discussed earlier; basically they are helpful in alerting him to general class problems and individual pitfalls. They are also beneficial in evaluating the effectiveness of the tests and the teaching methods used.

Pre-Course Planning for CMI

Below is an outline of some principal suggestions to follow in adapting your Introductory Sociology course for CMI. You will find in this outline general guidelines for building a test, applicable to any course of instruction, including specific hints for writing test questions.

1. *Defining Objectives*

   Start by clearly setting forth objectives, or general conceptual areas to be covered during your Sociology course. These can be gleaned from any course plan.

2. *Building Test Questions*

   Once objectives are drawn up, writing test questions become much simpler. The instructor's task is how to prepare test questions that best assess and measure the objectives set forth.

3. *Structuring a Balanced Test*

Good tests should reflect the course material. They should include a representative sampling of subject content. However, an instructor may want to test certain objective more rigouously than others. An objective can be given more emphasis by having more questions on it, or by being assigned more weight to the questions in each version.

4. *Question Construction*

It is possible to use ingenuity in writing test questions. Constructing imaginative questions that gauge understanding of fine points of course material as well as testing minimum knowledge is important and useful in classes that are either large, or composed of varying student levels.

5. *Writing Prescriptions*

Prescriptions can take the form of comments, directions, assignments for further study, or anything the instructor chooses.

6. *Designing to Specifications*

The instructor must know in advance how many questions he wants to appear in each computer-generated version. In order to randomly generate test versions that are sufficently different, the system must be supplied with an extensive surplus of questions.

7. *Testing the Test*

"Testing" the finished test itself is probably a good idea for teachers no matter how experienced in this kind of testing. In this way they can be assured that the questions and areas tested are well-balanced. It might even be helpful to give the test to an assistant or someone else, just to get a reaction, and to get out any remaining "bug" in the test--example of poor or unclear wording, self-defining answers, or possible discrepancies between the questions and their respective answers.

Conclusion

As previously identified PSI is unique in that individualization of instruction is achieved by enabling students to progress through the courses at their own pace, while simultaneously providing each student with frequent face-to-face instructional assistance.

PSI has not progressed very rapidly in higher education because instructors have not been able to manage the system properly. It created too much testing, too much diagnosis and too much paperwork.

A CMI system like TIPS or COMPASS, provides the instructor with valuable assistance to generate multiple versions of various tests, correct and record the data, and provide prescriptions for student growth. If CMI can solve our managerial problems then individually paced instruction can truly be realized in higher education.